Course Title: Communication systems	Course Code: EEC2247	Second Year
Date: 26-5-2013	Allowed time: 3 hrs	No. of Pages: (2)

Answer all the following questions:

Question (1) (10 degrees)

(1) Find the trigonometric Fourier series for the periodic waveform $g(t) = |\sin(t)|$ shown in Figure (1). (A=1)

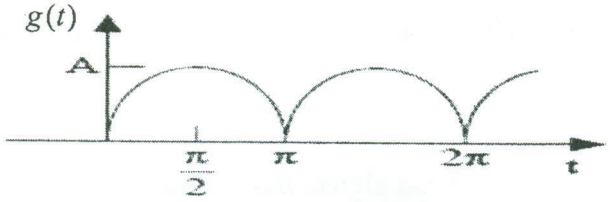

Figure (1)

(2) Find the complex Fourier series and the PSD for the periodic delta waveform shown in Figure (2).

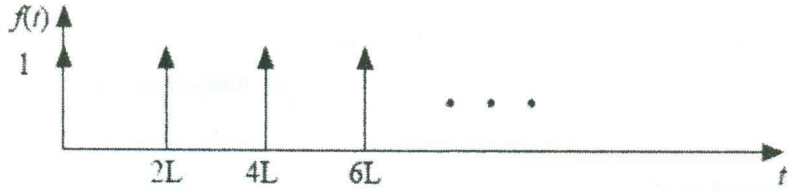

Figure (2)

Question (2) (20 degrees)

(1) The Fourier transform of a signal $g(t)$ is denoted by $G(f)$. Prove the following property of the Fourier transform:

$$\int_{-\infty}^{\infty} g(t)dt \Leftrightarrow \frac{1}{j2\pi f}G(f) + \frac{G(0)}{2}\delta(f)$$

(2) If $w(t) = rect.(\frac{t}{T})$, Find its Fourier transform, then find X(f) that satisfies the following relationships:

(a) $x(t) = w(2t+2)$

(b) $x(t) = e^{-j2\pi}w(t-1)$

(c) $x(t) = \frac{d\ w(t)}{dt}$

Question (3) (25 degrees)

(1) An AM signal is generated by modulating the carrier wave f_c=800 kHz by the signal $m(t) = 5\cos(4000\pi t)$, the AM signal is given as $s(t) = 100[1+m(t)]\cos(2\pi f_c t)$, is fed to a 50 Ω load:

a. Determine and sketch the spectrum of the AM signal.

b. Determine the average power in the carrier and in the sidebands.

c. What is modulation index?

d. What is the peak power delivered to the load?

e. Explain one method that can be used to demodulate the AM signal.

(2) A signal *m(t)=4cos (1000πt)*, is transmitted by DSB-SC modulator by using a carrier $c(t) = 10\cos(20000\pi t)$, determine the following:

(a) The spectrum of the DSB-SC signal.

(b) Identify the frequencies in the baseband, and the corresponding frequencies in the USB and LSB spectra.

(c) Show, how you can recover the baseband signal from the DSB-SC wave by using the squaring loop receiver.

(d) If the noise power spectral density $N_0 = 10^{-3}$ adds during transmission, find the SNR at the output of the receiver.

Question (4) (20 degrees)

(1) A SSB-AM transmitter is modulated with the baseband signal $m(t) = 2\cos(400\pi t)$, the carrier signal has $A_c = 2, and \quad f_c = 2kHz$.

(a) Evaluate $\hat{m}(t)$.

(b) Find the expression for the upper SSB signal.

(c) Sketch the amplitude spectrum of $|S(f)|$.

(d) Find the normalized average power of the SSB signal.

(2) Explain the difference between the single-sideband amplitude modulation and the Vestigial sideband amplitude modulation.

Question (5) (25 degrees)

(1) An FM transmitter has a block diagram as shown in Figure (3). The audio signals containing frequencies in the range of 20 Hz to 15 kHz band. The FM output signal is to have a carrier frequency of 103.7 MHz and maximum frequency deviation $\Delta f = 75\ kHz$

(a) Find the bandwidth and the center frequency required for the bandpass filter.

(b) Calculate the frequency f_0 of the oscillator.

(c) What is the required peak deviation of the FM exciter?

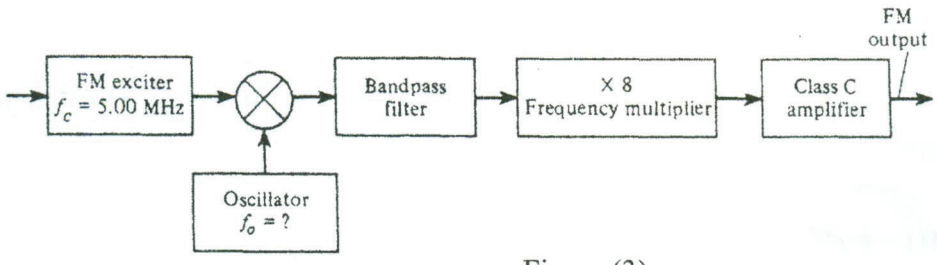

Figure (3)

(2) A single-tone FM signal is given by $s(t) = 10\sin[16\pi \times 10^6 t + 20\sin(2\pi \times 10^3 t)]volts$. Determine the modulation index, frequency deviation, the carrier power, and calculate the bandwidth of the FM signal using Carson's rule.

(3) Explain one method used to demodulate the FM wave.

Good Luck

Dr. *Entessar Said*